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AFPTEF PROJECT NO. 93-P-107

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Research Testing of Commercial Retractable Handles for Small Containers

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AIR FORCE PACKAGING TECHNOLOGY AND ENGINEERING FACILITY
WRIGHT PATTERSON AFB, OH 45433-5540
January 1996

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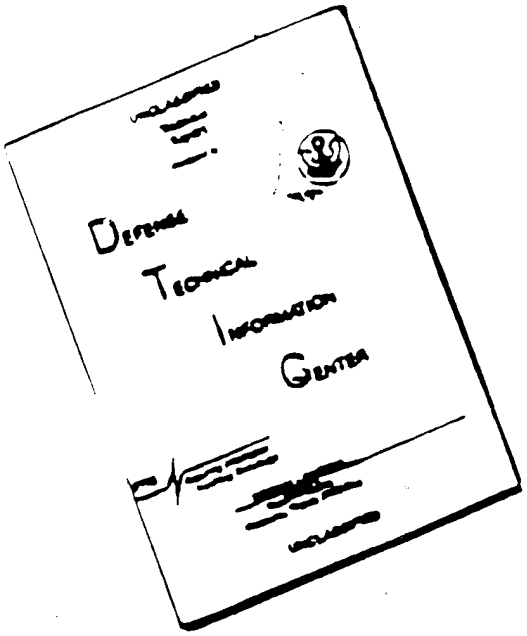

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PROJECT NO. 93-P-107
TITLE: Research & Testing of Commercial Handles for Small Containers

ABSTRACT

This project was established to identify handle manufactures and their products with some type of handle strength rating. Currently AFPTEF is using aluminum rod bent into a handle shape. The handle is held in place with a cotter pin and aluminum blocks welded to the container wall. This design was developed at AFPTEF to fulfill users need for field repairable handles.

AFPTEF's handles met the users need, however, the handles are not retractable, i.e. spring loaded, and would swing out from the container wall during drop testing. On small containers experiencing free fall drop testing, the handles would get damaged between the container and the ground. The damage was sporadic, therefore, AFPTEF wanted to look at the retractable handles that would hold the handle up against the container wall. The AFPTEF's goal was to test the commercial handles and certify them to a rated load and eliminate the need to repeat testing of handles on other containers.

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TABLE OF CONTENTS

APPENDICES

RESEARCH TESTING
OF
COMMERCIAL RETRACTABLE HANDLES
FOR
SMALL CONTAINERS

INTRODUCTION:

This project was established to identify handle manufactures, their products, and establish a handle strength rating. Currently AFPTEF is using aluminum rod bent into a handle shape. The handle is held in place with a cotter pin and aluminum blocks welded to the container wall. This design was developed at AFPTEF to fulfill users need for field repairable handles.

AFPTEF's handles met the users need, however, the handles were not retractable, i.e. spring loaded, and would swing out during drop testing. On small containers experiencing free fall drop testing, the handles would get damaged between the container and ground. The damage was sporadic, therefore, AFPTEF wanted to look at retractable handles that would hold the handle up against the container wall.

AFPTEF's goals were:

- To establish a standard test for commercially manufactured handles.
- To establish a rating system for the handles with handle manufactures and part numbers identified.
- To eliminate repetitive testing of the same handle over again and be able to reference this project to verify handle performance.

TEST PROCEDURE:

The handles are attached to a container wall with four rivets. The handle is rotated until it comes in contact with a physical stop. The angle of the handle is then measured with respect to the container wall. This angle is call the rotation angle and is to be measured and recorded prior to testing. The handle is then pulled from side to side to measure any lateral movement the handle may have. The measurement is taken from the edge of the plate to the inside of the bail. The lateral movement is recorded.

The container is secured to the floor and the handles are pulled in four different directions using a hydraulic tensile tester, see Figure 1. The four directions are described in the test plan, Attachment 1. The pulling force starts at 50 Kg $\pm$ 2 Kg and increase in increments of 10 Kg $\pm$ 2 Kg. At each 10 Kg increase, the handle is visually inspected and measured for bending and/or

pulling away from the container. The force is held for a minimum of 1 minute.

At 120 Kg and each 10 Kg interval after, the force is removed and the handle is observed for permanent deformation and performance. The force at which one starts removing the force for a closer inspection may vary depending on the handle being tested. When permanent deformation occurs, testing is completed.

RESULTS:

The handles were manufactured by Nielson Hardware and made of stainless steel, i.e. the bail, plate, and spring. The part number for the handle is H945-3500SS2RG75SS-01. The bail size is 127 mm X 77 mm. The handle had a 94° rotation at the physical stop and 10 mm lateral movement in each direction. The part number of the rivet is CR3213-5-4. See Table I for test results.

During Test A visual inspections were made with the applied force removed. The applied force and comments of the visual inspection are below:

- 80 Kg, the handle functioned normally with an increase rotation up to 105°.
- 100 Kg, the handle functioned normally with an increase rotation up to 112°. The physical stop started to show slight deformation, see Figure 2.
- 130 Kg, the handle functioned normally with a rotation of 112°.
- 160 Kg, the handle functioned normally. The bail flexed past the physical stop. This changed the angle the applied force was pulling.
- 200 Kg, the handle functioned normally.
- 220 Kg, the handle is starting to show signs of deformation. The spring action is a little hampered.
- 250 Kg, the handle came in contact with the container when the load was applied, see Figure 3. The spring action failed to return the bail completely back against the container wall.

During Test B visual inspections were made with the applied force removed. The applied force and comments of the visual inspection are below:

- 150 Kg, the handle functioned normally.
- 170 Kg, the handle functioned normally. When load applied, the bail flexed 5 mm.

- 200 Kg, the handle functioned normally. When load applied, the bail flexed 10 mm.
- 250 Kg, the handle functioned normally. When load applied, the bail flexed 10 mm. The force was increased.
- 350 Kg, the handle functioned normally. The spring action is slightly hesitant, but retracts the bail completely.
- 400 Kg, the handle functioned normally. Spring action still hesitant. When load applied, the bail flexed 15 mm.
- 420 Kg, the handle functioned normally. Spring action hesitation is increasing. Bail starting to show signs of deformation, see Figure 4.
- 430 Kg, spring action more hesitant and not completely returning bail to container wall. Bail deformed.
- 460 Kg, spring action failed to return the bail to the container wall. Bail deformed 25 mm.

During Test C1 visual inspections were made with the applied force removed. The applied force and comments of the visual inspection are below:

- 120 Kg, spring action hesitant. Bail starting to show signs of deformation, see Figure 5.
- 140 Kg, spring action failed. Bail deformed, see Figure 6.

During Test C2 visual inspections were made with the applied force removed. The applied force and comments of the visual inspection are below:

- 120 Kg, the handle functioned normally.
- 150 Kg, bail showing signs of deformation, see Figure 7. Spring action is normal.
- 170 Kg, spring action hesitant. Bail deformed, see Figure 8.
- 180 Kg, spring action more hesitant.
- 200 Kg, spring action failed.

CONCLUSION:

The handles performed well. The handles were removed from the container and inspected. The cause of the spring failure for Tests C1 & C2 was determined to be the bail pulled out beyond the spring. This allowed the tension in the spring to be released. In Tests A & B the cause of the spring failure was determined to

be the bail being bent in the area where the spring wrapped around the bail. This caused friction between the bail and spring and didn't allow the spring to retract the bail.

RECOMMENDATIONS:

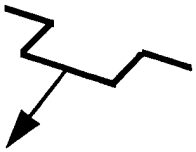
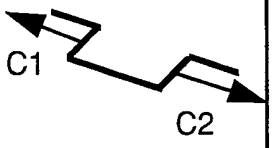
From the results in Tests A & B only, which is consider the working directions of the handle, the handle could be rated at a maximum load of 220 Kg, however, fatigue factor is not accounted for in this test. Therefore, the work load for the handle should be a certain percentage from the maximum load.

From the results in Tests C1 & C2 only, the handle could be rated at a maximum of 120 Kg. Again, the working load should be a percentage of the maximum load, however, this percentage can be lower than the percentage used to determine the load for the working direction. This test was design to simulate the possibility of the handle being used as a tie down point. The direction that was pulled is considered a worst case scenario.

APPENDIX 1

TEST PLAN

AIR FORCE PACKAGING TECHNOLOGY AND ENGINEERING FACILITY (HANDLE TEST PLAN)			AFPTEF PROJECT NUMBER: 93-P-107	
HANDLE SIZE (MILLIMETERS) BAIL (W X D): 113 X 55	EXTERIOR (L X W X D): 130 X 120 X 15	HANDLE ROTATION: 90 DEGREES	QUANTITY: 4	DATE: 01 Mar 93
ITEM NAME: Retrackable Handle		MANUFACTURER: Nielson Hardware		
PART NUMBER: H945SS2RGSS			HANDLE COST: N/A	
HANDLE DESCRIPTION: Spring loaded, retrackable, stainless steel plate, spring, and bail.				
CONDITIONING: As noted below				

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	HANDLE ORIENTATION	INSTRU-MENTATION
1.	HANDLE HOISTING/PULL TEST			
a.	MIL-STD-648 Para. 4.17.2.1 Part C, Para. 5.8.3 Modified	At the center of a handle, apply a force of 200 kg in the upward direction, parallel to the container side.		Visual Inspection (VI)
b.	(4.7.4) Modified	At the center of a handle, apply a force of 200 Kg in the direction perpendicular to the container side.		VI
c.	(4.7.4) Modified	At the center, on the side of the handle, apply a force of 180 Kg in the direction parallel to the container side. Both directions.		VI

COMMENTS:
* Figures in parenthesis () refer to paragraphs in MIL-C-5584D.

PREPARED BY:	APPROVED BY:
Robert Tekesky, Mechanical Engineer	Ted Hinds, Chief, Design Group, AFPTEF

APPENDIX 2

TEST RESULTS

TABLE I
Applied Forces and Results

Applied Force (Kg)	Test A Rotation	Test B	Test C1 Lateral Movement	Test C2 Lateral Movement
50	113°	PASSED	22 mm	16 mm
60	115°	PASSED	22 mm	17 mm
70	117°	PASSED	22 mm	17 mm
80	123°	PASSED	23 mm	17 mm
90	130°	PASSED	25 mm	18 mm
100	151°	PASSED	26 mm	18 mm
110	155°	PASSED	27 mm	18 mm
120	155°	PASSED	28 mm	19 mm
130	156°	PASSED	30 mm	21 mm
140	158°	PASSED	32 mm	21 mm
150	159°	PASSED	35 mm	22 mm
160	162°	PASSED		MISSED
170	167°	PASSED		24 mm
180	167°	PASSED		27 mm
190	168°	PASSED		28 mm
200	168°	PASSED		29 mm
210	168°	PASSED		
220	168°	PASSED		
230	168°	PASSED		
240	170°	PASSED		
250	170°	PASSED		

APPENDIX 3

PHOTOGRAPHS

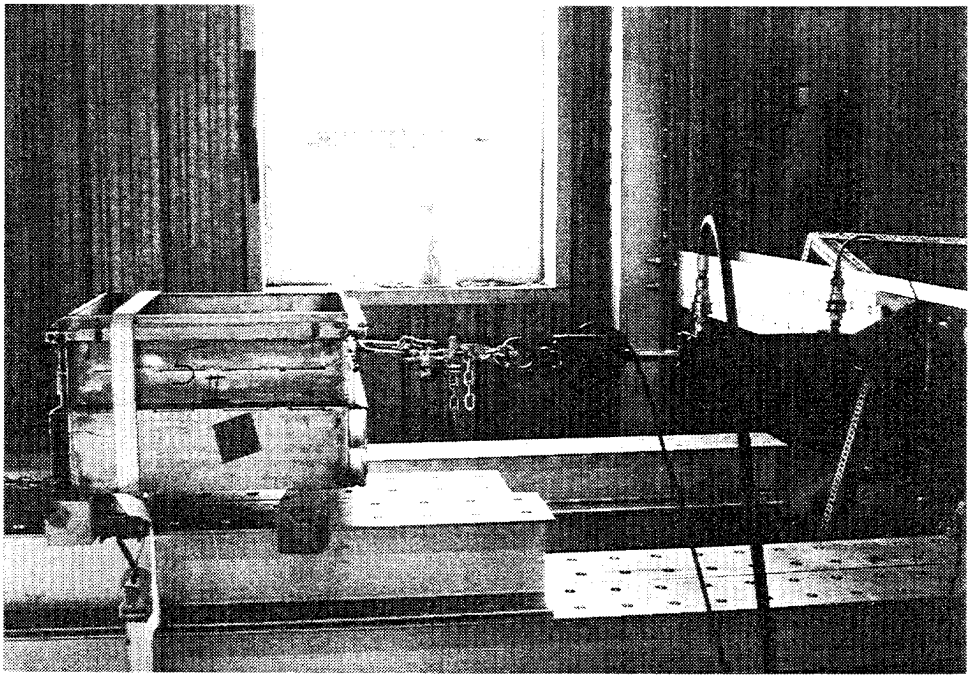


Figure 1. TEST SETUP.

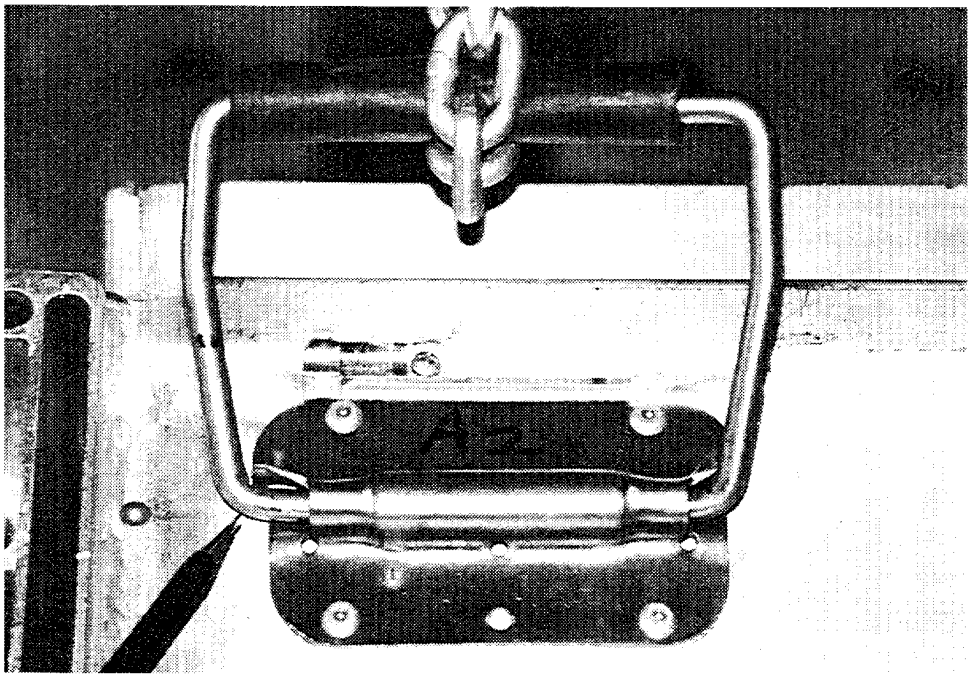


Figure 2. PHYSICAL STOP DEFORMATION.

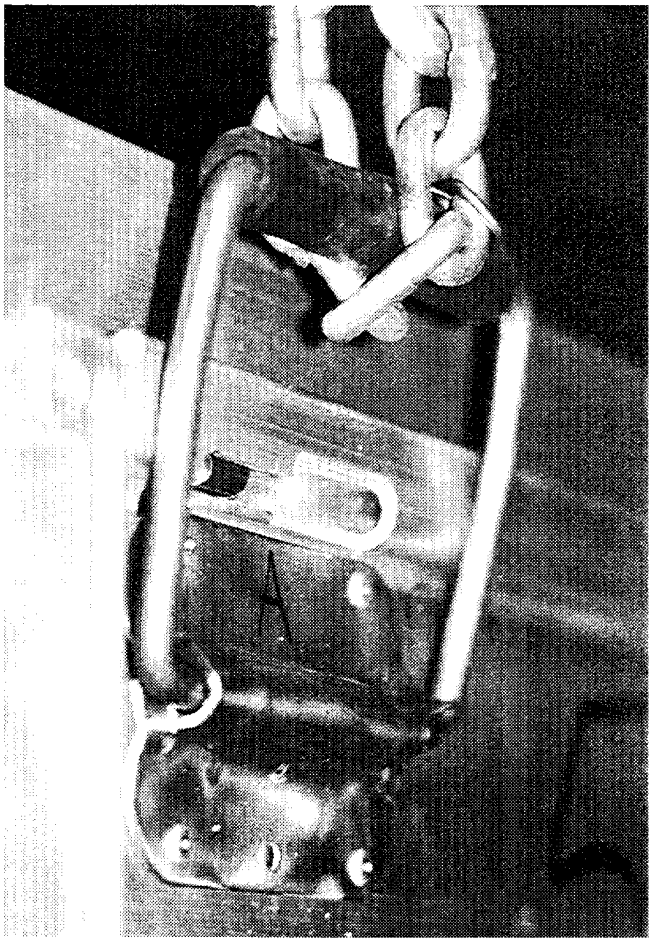


Figure 3. 250 Kg LOAD APPLIED.

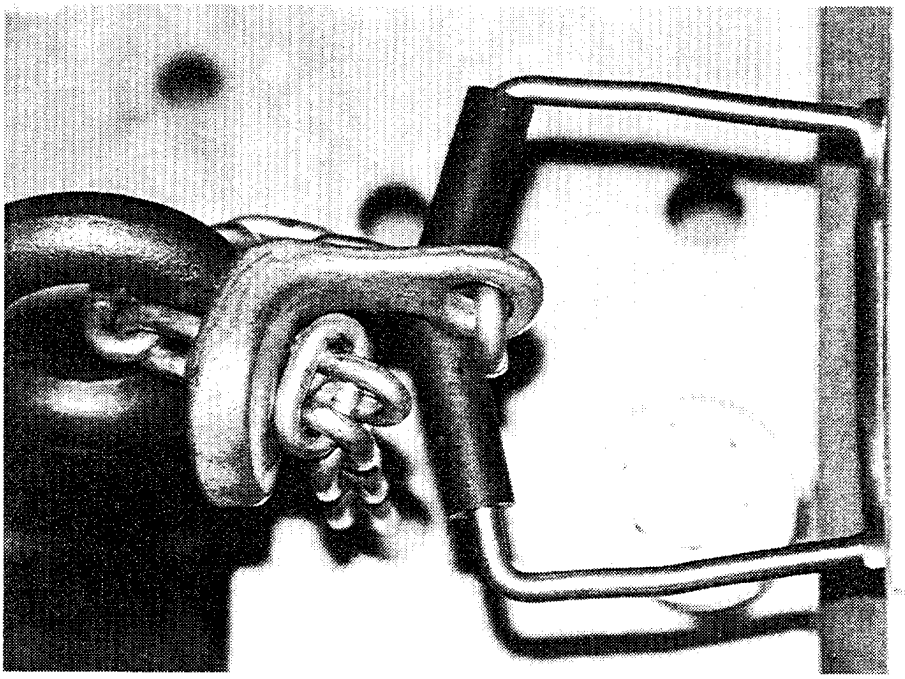


Figure 4. BAIL DEFORMATION.

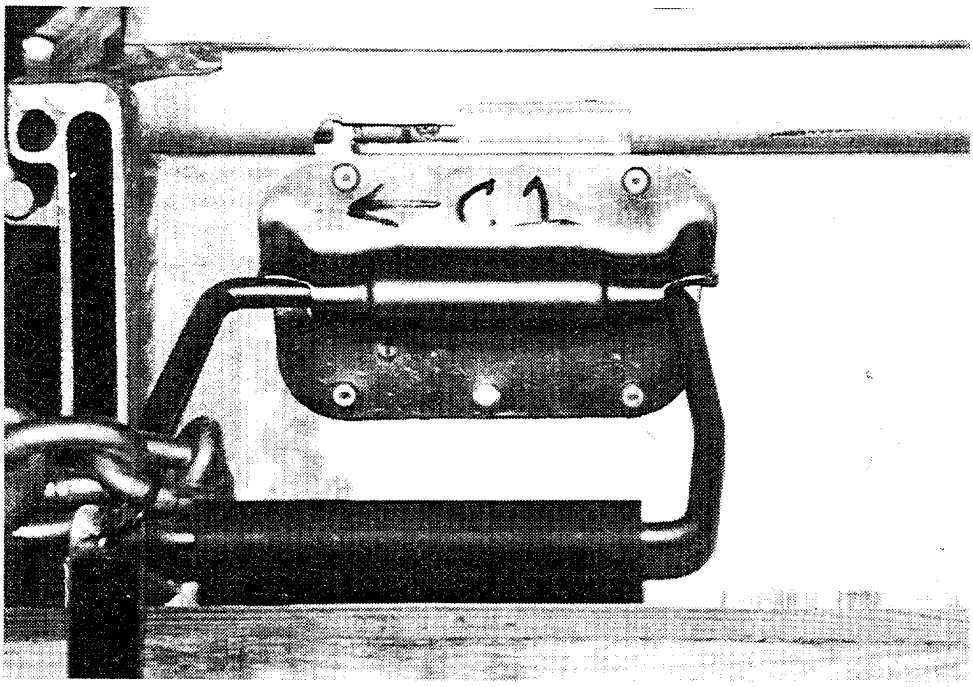


Figure 5. BAIL SHOWING SIGNS OF DEFORMATION.

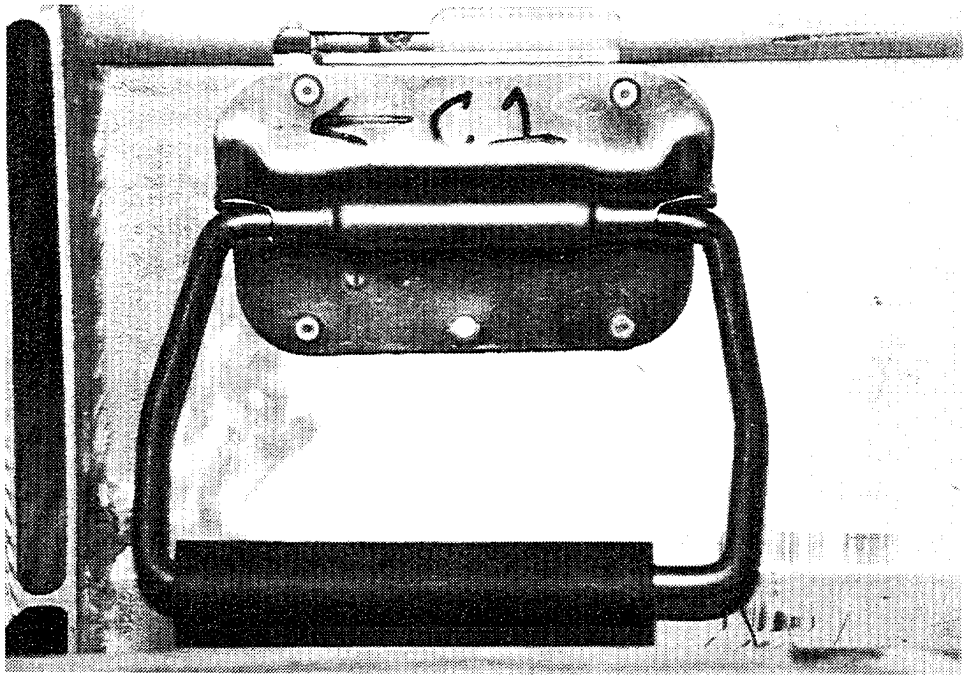


Figure 6. BAIL DEFORMATION.

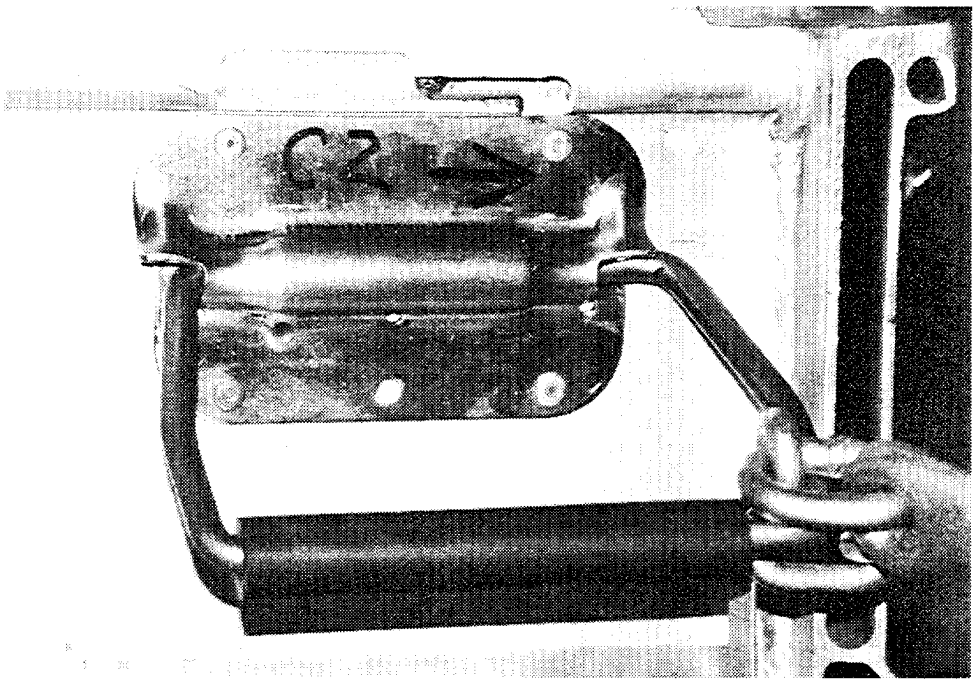


Figure 7. BAIL SHOWING SIGNS OF DEFORMATION.

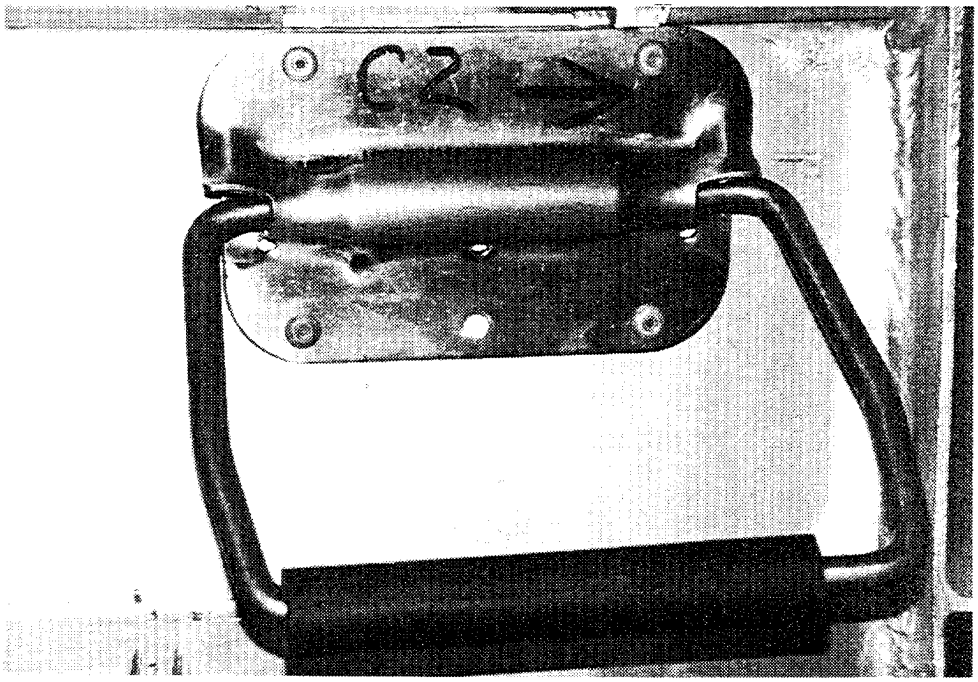


Figure 8. BAIL DEFORMATION.

APPENDIX 4

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APPENDIX 5

REPORT DOCUMENTATION

REPORT DOCUMENTATION PAGE

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13. ABSTRACT *(Maximum 200 words)*

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